



## HV POWER CABLES INSTALLED IN MULTI PURPOSE TUNNELS, A CHALLENGEABLE OPTION!



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### ABSTRACT

*If a HV power cable is installed in a tunnel, many aspects are different compared with the classical ways of cable installation. In case of a multi-purpose tunnel an analysis has to be performed to specify the different mutual influences under normal operating and under failure conditions. The influences dealt with in this paper are the thermal aspects, magnetic fields, induced voltages in nearby infrastructures, failure risks and the procedures for inspection, maintenance, alarm detection et cetera. These aspects will be discussed based on recent practical experience and it will be demonstrated that power cables can be effectively installed in multi-purpose tunnels.*

### KEYWORDS

Power cable, installation, multi purpose tunnel, forced air ventilation, magnetic field, mutual influence, risk analysis.

### 1. INTRODUCTION

Cables can be installed in several ways: direct burial, in ducts, in directional drillings and in tunnels [1,2]. Every method has its pro's and con's. Quite often methods of installation are historically determined. For instance in some countries direct burial is common practice, in others the duct or conduit system is being used for a long time. A more novel technique like HDD is being selected on careful cost/benefit considerations. The tunnel option to accommodate HV cables is not particularly modern; as for many years this method is being used worldwide. However a tunnel accommodating different systems (multi purpose tunnel), including HV cables is to be considered as an innovative method of installation and is getting more attention.

The main reason for this attention is related to the increased pressure from the authorities to exchange "chaos" in the soil by "law and order" in a tunnel (see figure 1) and last but not least to reduce cost by allowing different parties to share costs in one multi purpose tunnel.

The main advantages of such a multi purpose tunnel can be briefly summarized as follows:

- Efficient use of the soil
- Easy accessibility in case of maintenance and repair
- Adequate protection against external damage

The main disadvantages are:

- Mutual impact between different systems
- Complicated organizational structure
- High costs



Figure 1: An orderly multi-purpose tunnel interior with HV cables and different pipes for transporting liquids and gasses.

In this paper, based on recent practical experience both in the Netherlands and abroad, the different issues will be dealt with. In particular typical cable issues or cable problems will be considered and will be analyzed to get them under control between acceptable limits:

- Thermal aspects
- Magnetic fields
- Induced voltages
- Failure behaviour

Finally future developments and conclusions will be given, going in the direction that the multi purpose tunnel is a challengeable option for installing HV cables in the future.

### 2. SINGLE PURPOSE VERSUS MULTI PURPOSE TUNNELS

When power cables are installed in a tunnel with electric cables only, this refers to the situation of a single purpose tunnel. However when a cable is installed in a tunnel together with other systems (gas, chemicals, water, etc.), the cable is part of a so-called multi purpose tunnel, see figure 2 for an impression.